(19) Europäisches Patentamt
European Pat nt Office
Office européen des brevets

(11) EP 1 128 006 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
29.08.2001 Bulletin 2001/35

(51) Int Cl.[7]: E05B 47/00, E05B 65/12, E05B 15/04, H02K 7/00

(21) Application number: 01300813.1

(22) Date of filing: 30.01.2001

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: 18.02.2000 GB 0003686

(71) Applicant: Meritor Light Vehicle Systems (UK) Ltd
Birmingham B30 3BW (GB)

(72) Inventor: Spurr, Nigel Victor
Birmingham B28 ORP (GB)

(74) Representative: Jones, John Bryn et al
Withers & Rogers,
Goldings House,
2 Hays Lane
London SE1 2HW (GB)

(54) **Actuator assemblies**

(57) *An actuator assembly (10) including an actuator (14) drivingly connected by a transmission path (16) to an output member (18), the actuator being capable of moving the output member in a first direction from a rest condition of the actuator assembly to an actuated condition, and also being capable of moving the output member in a second direction from the actuated condition to the rest condition, the actuator assembly further including an energy storing means (20), in which movement of the output member by the actuator in the first direction is assisted by the energy storing means and movement of the output member in the second direction by the actuator stores energy in the energy storing means (figure 1).*

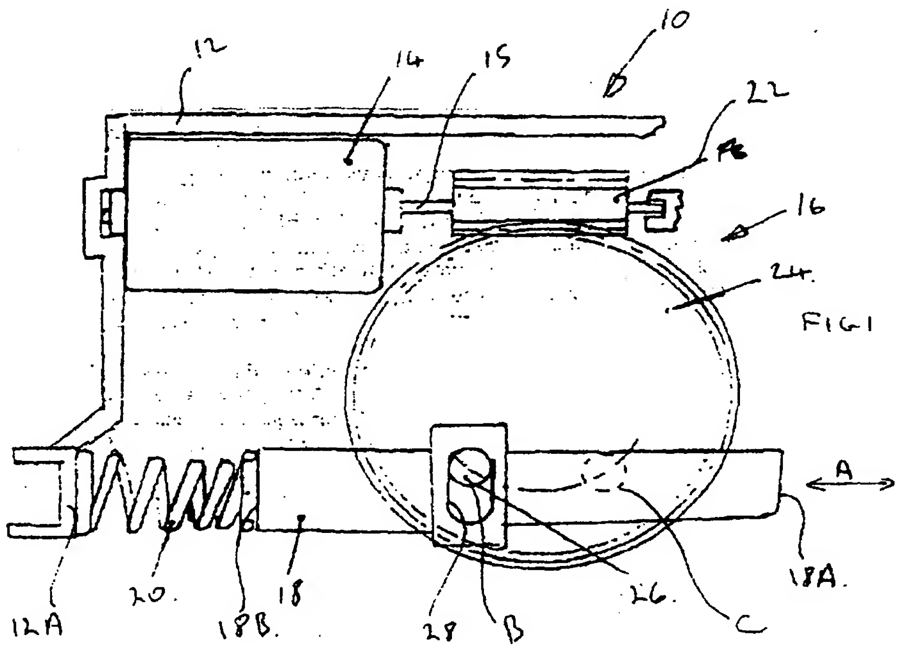

FIG 1

EP 1 128 006 A2

Description

[0001] The present invention relates to actuator assemblies and in particular actuator assemblies used to release or latch vehicle door latches.

[0002] Known actuator assemblies when used in vehicle door latches are only required to provide an output in one direction when actuating. The actuator assembly is returned to a rest position by powering of an actuator assembly motor in a reversed direction. This return stroke does no work.

[0003] Thus according to the present invention there is provided an actuator assembly including an actuator drivingly connected by a transmission path to an output member, the actuator being capable of moving the output member in a first direction from a rest condition of the actuator assembly to an actuated condition, and also being capable of moving the output member in a second direction from the actuated condition to the rest condition, the actuator assembly further including an energy storage means in which movement of the output member by the actuator in the first direction is assisted by the energy storage means, and movement of the output member in the second direction by the actuator stores energy in the energy storage means.

[0004] Advantageously such an arrangement allows the actuator assembly to produce a higher output force. Furthermore where the transmission path includes gears, smaller gears may be used. The invention also provides an actuator assembly which can operate faster. Furthermore the actuator assembly may produce the same output force with a lower powered actuator.

[0005] The invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a view of an actuator assembly according to the present invention;

Figure 2 is a partial view of second embodiment of an actuator assembly according to the present invention;

Figure 3 is a view of a third embodiment of an actuator assembly according to the present invention; and

Figure 4 is a partial view taken in the direction of arrows C of figure 3.

[0006] With reference to Figure 1 there is shown an actuator assembly 10 including a housing 12 (only partially shown), an actuator in the form of an electric motor 14, a transmission path 16, an output member 18 and an energy storage means in the form of a compression spring 20.

[0007] The transmission path 16 includes a worm gear 22 which engages a worm wheel 24. Worm gear 22 is mounted rotationally fast on motor shaft 15.

[0008] Worm wheel 24 is rotationally mounted on the housing 12 and includes a crank pin 26.

[0009] Crank pin 26 engages in a lateral slot 28 of output member 18.

[0010] Output member 18 is guided by guides (not shown) for reciprocating linear movement in the direction of arrow A. Output member 18 has an output abutment 18A at one end thereof and a spring abutment 18B at the other end thereof.

[0011] Spring 20 is mounted between a portion 12A of housing 12 and spring abutment 18B of the output member 18.

[0012] Operation of the actuator assembly is as follows.

[0013] Figure 1 shows the actuator assembly in an at rest position with spring 20 having being compressed (see below). Thus spring 20 biases the output member 18 to the right as shown in Figure 1 and this bias load is resisted by the crank pin 26. In this case the helix angle of the teeth of the worm gear 22 and worm wheel 24, combined with the various frictional loses in the transmission path result in the bias load (spring force) provided by compressed spring 20 being unable to back drive motor 14, i.e. turn motor 14. The actuator assembly thus remains in its at rest position shown in figure 1.

[0014] When actuation is required, an electrical current is supplied to motor 14 resulting in shaft 15 rotating and ultimately in worm wheel 24 rotating in an anticlockwise direction when viewing Figure 1. This results in the crank pin 26 moving from position B of Figure 1 to position C shown in Figure 1. This results in output abutment 18A contacting and moving further components (not shown) to, for example, release or latch an associated vehicle door latch. It will be noted that as output member 18 moves to the right as shown in Figure 1 it is assisted in moving in this direction by spring 20.

[0015] Once actuation has occurred, an electrical current is fed to the motor 14 causing it to run in a reverse direction resulting in the crank pin 26 moving from position C to position B and thus returning the output member to its at rest position. It should be noted that during the movement of the output member from its actuated position to its at rest position, spring 20 is caused to compress.

[0016] Thus when the actuator assembly is moving from its at rest position to its actuated position the spring 20 is releasing energy previously stored and acts to assist the motor. When the actuator assembly moves from its actuated position to its rest position the motor acts to compress spring 20, storing energy therein.

[0017] Once the reversing current to motor 14 has stopped, the actuator assembly remains in a position as shown in Figure 1 by virtue of the fact that spring 20 (which has now been compressed) is attempting to back drive motor 14 via the worm wheel and worm gear. Typically the worm wheel and worm gear would be 60% efficient and thus the various frictional loses associated

with the sliding output member 18, the worm wheel and worm gear, and the motor are sufficient to ensure that the actuator assembly remains in the position as shown in Figure 1 even when no power is supplied to motor 14.

[0018] With reference to Figure 2 there is shown a second embodiment of an actuator assembly 40, identical to actuator assembly 10 apart from the fact that spring 42 has a higher spring rate than spring 20 and actuator assembly 40 also includes a detent arrangement 44 in the form of a plunger 46 which is biased in the direction of arrow D by spring 48. Output member 50 includes a detent notch 52 into which plunger 46 can engage.

[0019] Thus when the actuator assembly 40 is in its at rest position as shown in Figure 2 plunger 46 engages detent notch 52 and acts to realeasably retain the actuator assembly in its at rest position.

[0020] When the actuator assembly 40 is required to actuate, the motor is arranged such that it can, in conjunction with the increased load provided by spring 42, overcome the retaining action of the detent, following which the actuator assembly can produce a higher actuating output force as a result of the greater force provided by spring 42.

[0021] In this case the output member 50 is linearly moveable and the detent arrangement acts substantially normally to the direction of movement of the output member. In further embodiments the output member could move in a rotational direction and a detent arrangement could act substantially normally to this rotational direction i.e. radially inwardly or radially outwardly.

[0022] In an alternative embodiment a clutch arrangement could be used to ensure that the actuator assembly remains in its at rest condition.

[0023] Such an arrangement is shown in figure 3. In this case the motor is connected to worm wheel 60 rotatably mounted about axis A.

[0024] Worm wheel 60 includes a drive pin 62 secured thereto and also a stop pawl disengaging ramp 64 also secured thereto having a ramp surface 66 and a radially outer surface 67.

[0025] Also pivotally mounted about axis A is an output lever shown generally at arrow 68. Output lever includes and output pin 70, an arcuate slot 72, within which drive pin 62 sits; and assist spring abutment 74 and stop abutment 76. An assist spring 78 acts on assist spring abutment 74 and reacts against housing 12 (only part of which is shown).

[0026] Assist spring 78 biases the output lever 68 in a clockwise direction when viewing figure 3.

[0027] An output lever stop pawl 80 is pivotally mounted about axis B and is biased in an anticlockwise direct when viewing figure 3 by a spring 82 which reacts against housing 12. Pawl end 84 is provided for contact with stop abutment 76.

Operation of the actuator assembly is as follows:-

[0028] The actuator assembly is positioned as shown in figure 3 in its rest position. Thus the assist spring 78 has been compressed and the output lever 68 is prevented from being rotated in a clockwise direction under the influence of assist spring 78 by abutment of stop abutment 76 against pawl end 84.

[0029] Actuation of motor 14 causes worm wheel 22 to rotate such that worm wheel 60 is caused. to rotate in a clockwise direction. Because of the arcuate slot 72, initially, drive pin 62 does not drive the output lever 68. However as the worm wheel rotates in a clockwise direction the ramp surface 66 of stop pawl disengagement ramp 64 acts on pawl end 84 to cam that end radially outward relative to axis A (it being noted from figure 4 that pawl end 84 is wide enough to be acted upon by both stop abutments 76 and stop pawl disengagement ramp 64). This causes pawl 80 to rotate in a clockwise direction until such time as the pawl end contacts the radially outer surface 67 of disengagement ramp 64. It should be noted that the radially outer surface 67 is positioned at a distance R from axis A which is greater than the outer most portion of stop abutment 76 (positioned at a radius r from axis A). Thus the stop pawl disengagement ramp 64 causes the stop pawl to disengage from the stop abutment 76 allowing the output lever 68 to rotate in a clockwise direction under the influence of assist spring 78 and drive pin 62 as it contacts end 72A of the arcuate slot 72.

[0030] This results in actuation of the components connected to output pin 70 since this pin moves from the position as shown in figure 3 clockwise for actuation.

[0031] Once actuation has being achieved, the motor 14 is powered in the reverse direction causing drive pin 62 to contact end 72B of the slot 72 which results in compression of the assist spring 78 and ultimately re-engagement of pawl end 84 against stop abutment 76 once stop abutment 76 has being rotated past pawl end 84.

[0032] In this case since the output lever is positively retained in its at rest position by pawl 80, the load in assist spring 78 when the actuator is in its at rest position is limited only by the ability of the motor 14 to compress spring 78 to its at rest position, and not by the friction developed in the transmission parts from the output lever to the motor. It can been seen that the arrangement shown in figure 3 provides for a clutch arrangement for ensuring that the actuator remains in its at rest position.

[0033] In further embodiments clutch arrangements can be used on output members which act in a linear direction as opposed to a rotational direction.

[0034] It can be seen that the friction within a transmission path, the detent arrangement, and the clutch arrangement each act as a retaining arrangement which releasably retains the actuator assembly in its at rest condition against the influence of the energy storage device such a springs 20, 42 and 78.

Claims

1. An actuator assembly including an actuator drivingly connected by a transmission path to an output member, the actuator being capable of moving the output member in a first direction from a rest condition of the actuator assembly to an actuated condition, and also being capable of moving the output member in a second direction from the actuated condition to the rest condition, the actuator assembly further including an energy storing means, in which movement of the output member by the actuator in the first direction is assisted by the energy storing means and movement of the output member in the second direction by the actuator stores energy in the energy storing means.

2. An actuator assembly as defined in claim 1 in which the actuator is operably connected to the energy storing means by at least a portion of the transmission path.

3. An actuator assembly as defined in claim 1 or 2 in which the actuator assembly includes a retaining arrangement to releasably retain the actuator assembly in the rest condition.

4. An actuator assembly as defined in claim 3 in which the retaining arrangement is at least provided by friction associated with at least one of the actuator, the transmission path and the output member.

5. An actuator assembly as defined in claim 3 or 4 in which the retaining means is at least provided by a detent arrangement.

6. An actuator assembly arrangement as defined in claim 5 in which the detent arrangement acts upon the output member.

7. An actuator assembly arrangement as defined in claim 6 in which the detent arrangement acts substantially normally to the direction of movement of the output member.

8. An actuator assembly as defined in any one of claims 3 or 4 in which the retaining means is at least provided by a clutch arrangement.

9. An actuator assembly as defined in claim 8 in which the clutch arrangement includes a pawl acting on the output member.

10. An actuator assembly as defined in claim 9 in which the pawl is disengaged by a pawl disengagement ramp of a component of the transmission path.

11. An actuator assembly as defined in claim 10 in which said component of the transmission path has a lost motion connection which the output member.

12. An actuator assembly as defined in claim 10 or 11 in which said component of the transmission path is a worm wheel.

13. An actuator assembly as defined in any preceding claim in which the transmission path includes a worm gear and worm wheel.

14. An actuator assembly arrangement as defined in claim 13 in which the actuator is operably connected to the energy storage means by at least the worm gear and worm wheel.

15. An actuator assembly as defined in claim 3 or 4 in which the worm wheel includes a crank pin acting on the output member.

16. An actuator assembly as defined in any preceding claim in which the first and second directions of movement of the output member are linear directions.

17. An actuator assembly as defined in any one of claims 1 to 15 in which the first and second directions of movement of the output member are rotational directions.

18. An actuator assembly as defined in any preceding claim in which the energy storage means acts on the output member.

19. An actuator assembly as defined in any preceding claim in which the energy storage means is a resilient means.

20. An actuator assembly as defined in claim 19 in which the resilient means is a spring.

21. An actuator assembly as defined in claim 20 in which the spring is a compression spring.

22. An actuator assembly as defined in claim 20 in which the spring is a tension spring.

23. An actuator assembly as defined in any preceding claim including a housing which at least partially contains the actuator, transmission path and the output member.

24. An actuator assembly as defined in claim 23 when dependent upon claim 5 in which the housing at least partially contains the detent arrangement.

25. An actuator assembly as defined in claim 23 when dependent upon claim 8 in which the housing at

least partially contains the clutch arrangement.

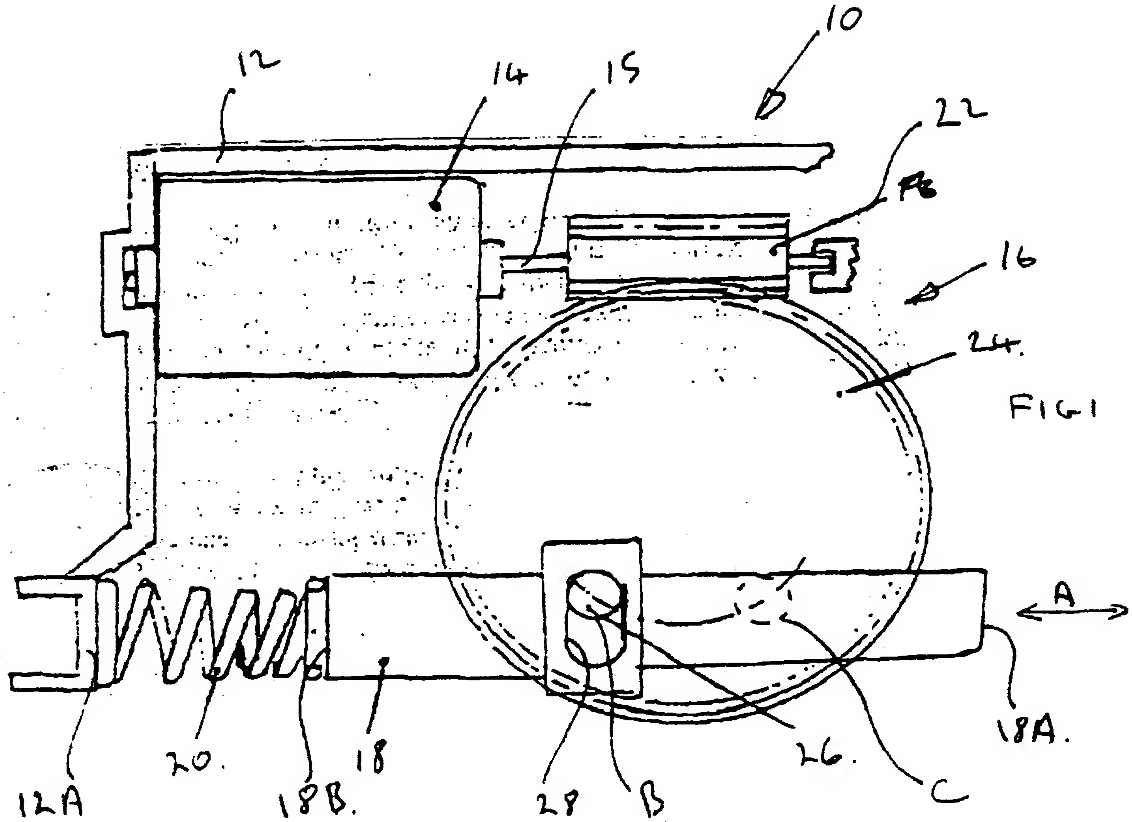
10
12
14
15
22
16
24
A
12A
20
18B
18
28
B
26
C
18A

FIG1

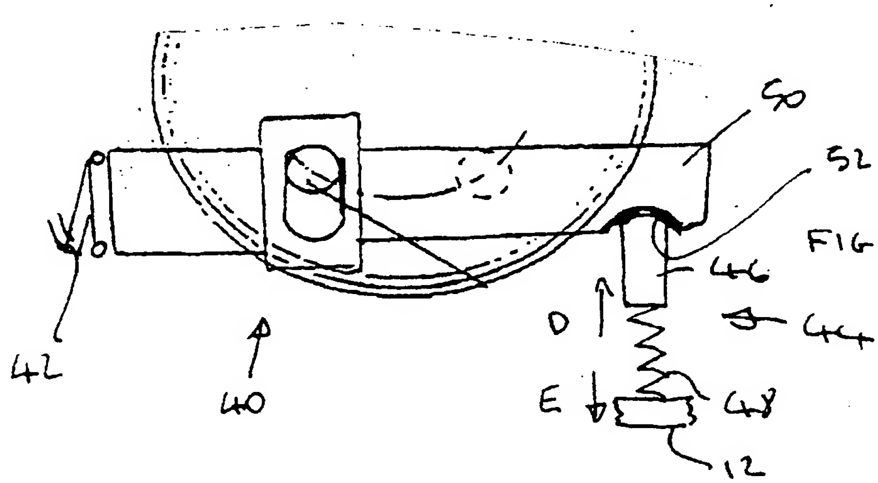
50
52
46
D
44
E
48
12
42
40

FIG2

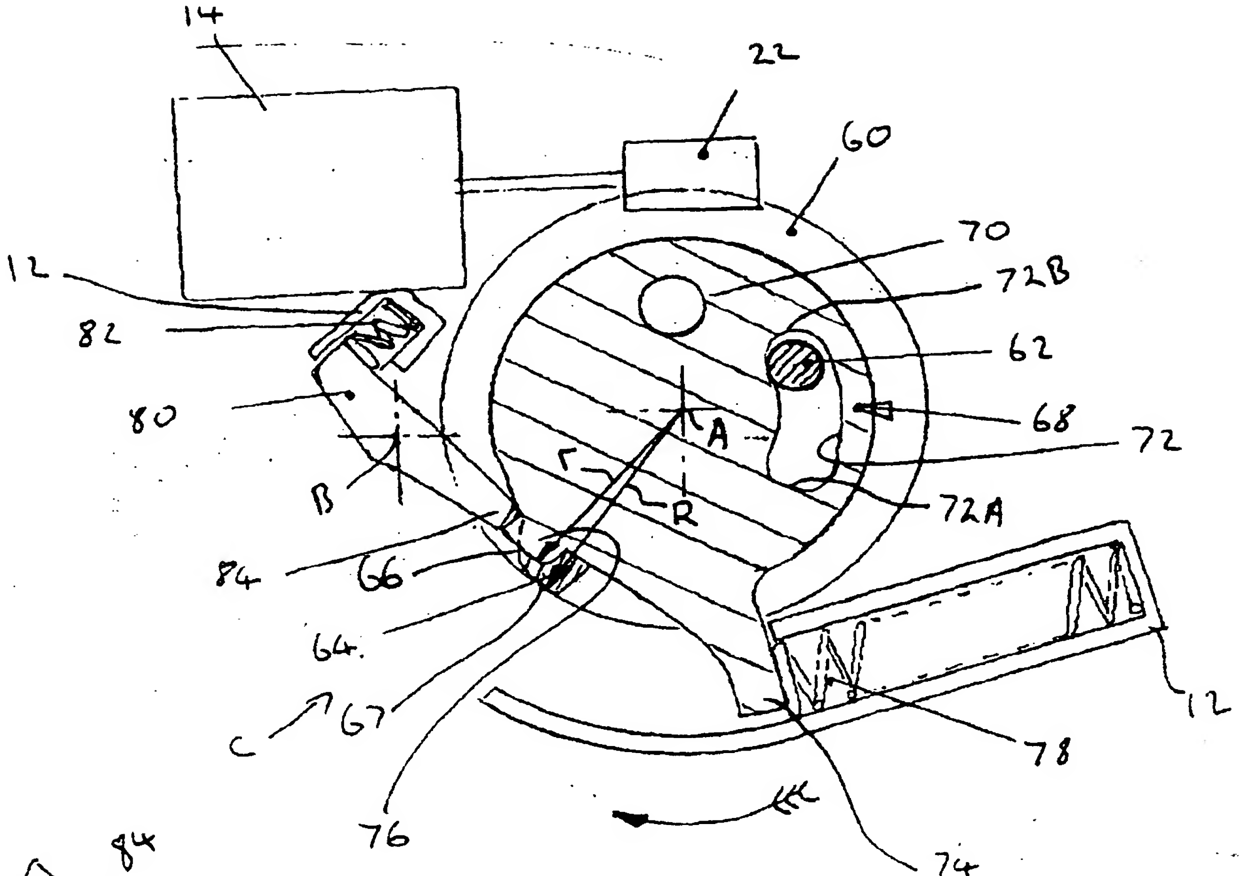
14
22
60
70
72B
62
68
72
72A
12
82
80
A
B
r
R
84
66
64.
C
67
76
78
12
74

FIG 3

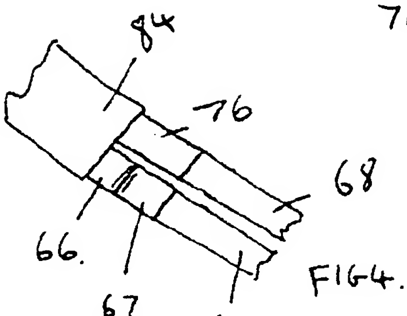
84
76
68
66.
67
60

FIG 4.